CHANGES IN TECHNOLOGY AND EMPLOYMENT IN AGRICULTURE

APPENDIXES A B C AND E

WORKS PROJECTS ADMINISTRATION
NATIONAL RESEARCH PROJECT
AND
U. S. DEPARTMENT OF AGRICULTURE

CHANGES IN TECHNOLOGY AND EMPLOYMENT IN AGRICULTURE

APPENDIXES A, B, C, AND E

by

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NOTE

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What would have been Appendix D in this booklet is printed in Changing Technology and Employment in Agriculture as "Appendix" (pages 181-189) without letter designation.

APPENDIX A

NOTES ON ESTIMATION OF POPULATION DEPENDENT ON AGRICULTURAL EMPLOYMENT

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NOTES ON ESTIMATION OF POPULATION DEPENDENT ON AGRICULTURAL EMPLOYMENT

I. Farm Operators and Their Dependents

These data were derived from Census data as follows:

A. "Owners and Tenants" from Fifteenth Census of the United States: 1930, Population, Vol. IV, "Occupations," table 13, p. 25, were broken down into "Owners" and "Tenants" by ratio derived from distribution of all operators in Census of Agriculture: 1935, Vol. III, table 6, p. 110.

B. Owners, Tenants, and Managers (same source as "Owners and Tenants") were then divided into residence groups by ratios derived from Census of Agriculture: 1935, Vol. III, table 6, p. 110.

C. Persons per family in owned and in rented homes were derived from Fifteenth Census of the United States: 1930, Population, Vol. VI, "Families," table 20, p. 14, by multiplying number of families by size of families (families of 12 or more taken as 13) and dividing cumulated products by total number of families.

D. The number of rural-farm owners and rural-farm managers, respectively, were multiplied by average number of persons per family in owned homes to obtain owner and manager population; rural-farm tenants were multiplied by persons per family in rented homes.

E. After the determination of hired laborer population (see under 2. below), a correction in rural-farm operator population was made as follows: The number of hired agricultural workers and nonagricultural workers which had been included in the operator population was distributed among the tenure groups in the proportion which each of these tenure groups is to the total operator population. These corrections were subtracted from the population by tenure groups as derived in (D).

II. Croppers and Dependents

Croppers are included in "Tenants and Dependents." Croppers were estimated by multiplying the number of sharecropper farms in 1930 (Census of Agriculture: 1930, Vol. II, part II, Southern States, table VI, p. 31) by average number of persons per sharecropper farm in 1935 (derived from U. S. Census of Agriculture: 1935, Vol. III, Chap. IV, pp. 153-5).

III. Laborers and Dependents

The farm laborer population was derived from Census data as follows:

A. Total rural-farm operators were subtracted from total rural-farm families (Fifteenth Census of the United States, Population, Vol. Vol. VI, table 20, p. 14) to obtain residual rural-farm families. Total uncorrected rural-farm operator population (see note I-D) was subtracted from total rural-farm family population (same source as total rural-farm families) to obtain residual rural-farm family population. From these data, average number of persons per residual rural-farm family was derived.

B. Number of rural-farm families with no gainful worker (Fifteenth Census of the United States: 1930, Vol. VI, table 54, p. 47) were subtracted from residual rural-farm families to obtain rural-farm families with gainful workers. This figure, multiplied by the average number of persons per residual rural-farm family, gives population in residual rural-farm families with gainful workers.

C. The number of hired agricultural wageworkers in the United States in 1930 was taken from Fifteenth Census of the United States: 1930, Population, Vol. IV, "Occupations," table 3, p. 7. The number of rural-farm agricultural wageworkers was obtained by applying a ratio derived from the preliminary distribution, ibid., 1930, Population, Vol. III, Part I, table 30, p. 22.

D. The number of lodgers on rural farms (Fifteenth Census of the United States: 1930, Population, Vol. VI, "Families," table 32, pp. 24-5) was assumed to measure the number of single laborers. Deducting this figure from total hired laborers on rural farms gives hired laborers in families on rural farms. The number of nonagricultural workers on rural farms was obtained from Fifteenth Census of the United States: 1930, Population, Vol. III, Part I, table 30, p. 22, by subtracting all agricultural workers on rural farms from workers in all industries on rural farms. A ratio was then derived to express the relationship of the hired laborers in families to the sum of the hired laborers in families and the nonagricultural workers.

E. This ratio was applied to the population in residual rural-farm families with gainful workers after corrections had been made as follows:

It was assumed that some of the hired agricultural workers and some of the nonagricultural workers, as recorded in the Census of Occupations, had been included in the operator population when operators were multiplied by persons per family. The extent to which these agricultural and nonagricultural hired workers were likely to be found in operator or residual population was assumed to be expressed by the ratio of operator population minus operators and unpaid family workers to the sum of this operator population and residual rural-farm population with gainful workers. This ratio was applied to the sum of agricultural and nonagricultural hired workers on rural farms to obtain that portion of these workers which should be deducted from operator population. The rural-farm operator population minus the figure just obtained was subtracted from the total rural-farm family population to obtain the corrected residual population in families with gainful worker on rural farms.

F. The ratio derived in (D) was applied to the corrected residual population to obtain the population dependent on agriculture in residual rural-farm families. The single laborers (lodgers) were added to this figure to obtain total hired laborer population living on rural farms. Dividing this by the total agricultural laborers on rural farms gives average persons per hired agricultural laborer.

G. The total hired laborers in agriculture were divided into residence groups by ratios derived from Fifteenth Census of the United States, Population, Vol. III, Part I, table 30, p. 22. These laborers by residence groups, multiplied by average number of persons per hired laborer, give hired laborer population by residence groups.

IV. Urban-farm Population

The number of urban-farm families was taken from Fifteenth Census of the United States: 1930, Population, Vol. VI, "Families," table 12, p. 10. The average size of operator family was used to determine the population in urban-farm families by applying ratios derived from the distribution of all urban operators.

V. Farm Operators Working Off the Farm and Their Dependents

A. The numbers of operators in 1929 working off the farm less than 150 days and those working off the farm 150 or more days were obtained from Fifteenth Census of the United States: 1930, Agriculture, Vol. IV, "General Report," Chap. V, table 23, pp. 432-3.

B. Ratios for distribution by tenure groups were derived from U. S. Census of Agriculture, 1935, Vol. III, "General Report," table 21, p. 222.

C. These ratios were applied to the data secured in (I) to obtain data by tenure groups for 1929.

D. To obtain data for operators and dependents, owners and managers were multiplied, respectively, by persons per family in owned homes, as derived from Fifteenth Census of the United States: 1930, Population, Vol. VI, "Families," table 20, p. 14. Data for tenants were multiplied by persons per family in rented homes, derived from the same source.

E. The number of operators reporting work off the farm who also reported that such work was principally in nonagricultural pursuits, was obtained for 1934 from U. S. Census of Agriculture, 1935, Vol. III, "General Report," Chap. IV, table 22, p. 232.

F. The ratio of those whose work off the farm was principally in nonagriculture to the total of those reporting work in nonagriculture and in agriculture, as derived from 1934 data, was applied to owners, managers, and tenants, respectively, in 1929, to obtain the number of those operators working off the farm 150 or more days who were also dependent mainly on nonagricultural pursuits. The numbers of such operators were multiplied by persons per family in owned or in rented homes, as explained in note (V-D), to obtain a population figure for the group.

APPENDIX B

TOTAL CAPITAL INVESTMENT AND INVESTMENT PER FARM

Table B-1.- TOTAL CAPITAL INVESTMENT, BY CLASS OF INVESTMENT AND BY FARMING AREA, FOR SPECIFIED YE[illegible]0-35

(Millions of dollars)

Class of investment	United States	Corn	Eastern Dairy	Western Dairy	Middle Eastern	Eastern Cotton	Delta Cotton	Western Cotton	Small Grain	Range	North Weste[illegible]	Cali-fornia	Other States
Land													
1910[a]	28,476	8,506	1,619	2,546	1,964	856	688	2,282	5,012	728	1,14[illegible]	1,317	1,807
1920[b]	54,830	16,147	1,879	5,328	4,040	1,960	1,633	4,417	10,009	1,598	1,896	2,783	3,140
1930[b]	34,930	7,733	1,459	3,078	2,640	1,009	1,132	4,094	6,139	1,255	1,451	2,976	1,965
1935[c]	32,859	6,986	2,630	3,456	2,873	1,083	1,042	3,358	4,816	1,089	1,307	2,325	1,892
Total capital goods													
1910	9,170	2,128	1,131	1,054	789	325	311	675	1,301	320	252	220	
1920	16,781	3,801	1,796	2,135	1,376	672	574	1,277	2,427	663	533	473	
1930	15,219	3,271	1,724	2,239	1,207	414	427	1,140	2,258	620	509	521	
1935	11,335	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
Farm buildings[d]													
1910[a]	2,865	763	541	427	237	76	56	108	307	40	53	56	208
1920[b]	5,203	1,388	742	832	436	166	112	233	631	88	120	122	319
1930[b]	5,866	1,472	843	1,011	504	139	117	269	695	110	159	183	362
1935	5,396[e]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Machinery													
1910[a]	1,265	261	189	155	98	51	53	84	181	28	40	36	88
1920[b]	3,595	806	397	471	254	146	116	235	589	97	135	136	213
1930[b]	3,302	621	389	458	210	86	103	275	607	109	133	136	176
1935	2,532[f]	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	[illegible]	
Workstock												[illegible]	202
1910[g]	2,622	567	184	231	272	138	131	253	440	70	78	[illegible]	170
1920[h]	2,570	437	177	208	310	207	189	296	380	79	74	[illegible]	77
1930[h]	1,351	259	95	161	171	95	92	140	169	38	3[illegible]	[illegible]	80
1935[i]	1,392	261	96	156	182	114	92	150	160	41	40		

Table B-1.- TOTAL CAPITAL INVESTMENT, BY CLASS OF INVESTMENT AND BY FARMING AREA, FOR SPECIFIED YEARS, 1910-[illegible] - Continued

(Millions of dollars)

Class of investment	United States	Corn	Eastern Dairy	Western Dairy	Middle Eastern	Eastern Cotton	Delta Cotton	Western Cotton	Small Grain	Range	North-western	[illegible]i-fornia	Other States
Other livestock													
1910 [j]	2,418	537	217	241	182	60	71	230	373	182	81	72	173
1920 [j]	5,413	1,170	480	624	376	153	157	513	827	399	204	72	339
1930 [k]	4,700	919	397	609	322	94	115	456	787	363	184	80	273
1935 [k]	2,015	409	214	241	158	57	62	180	258	143	89	39	115

[a]Fourteenth Census of the United States 1920, Agriculture, Vol. V, chap. I, table 12, pp. 48-9.

[b]Fifteenth Census of the United States 1930, Agriculture, Vol. IV, chap. I, table 13, p. 59.

[c]Census of Agriculture, 1935, Vol. III, chap. I, table 12, p. 34; land and buildings; no separate classification [illegible]able.

[d]Buildings other than dwellings; ratios of dwellings to all buildings in 1930 were applied to "all buildings" in [illegible] years to obtain data for buildings other than dwellings.

[e]Estimated by deducting for each year, 1930 to 1935, 4 percent of the value at the beginning of the year for depre[illegible]ion and normal repairs; then adding expenditures for repairs and new buildings as estimated by Bureau of Agricultural Economics, [illegible]s and Markets, Vol. XII, No. 7, (July 1935), p. 271 for 1930; data for 1931-34 from Bureau of Agricultural Economics, Income From [illegible] Production in the United States in 1935, p. 8, mimeo., (Sept. 1936).

[f]Estimated by deducting for each year from 1930 to 1935, 12 percent of value of implements at beginning of the yea[illegible] for depreciation and normal repairs; then adding expenditures for new purchases and repair parts from same source as in ftn. e abov[illegible]

[g]Fourteenth Census of the United States 1920, Agriculture, Vol. V, chap. IX, table 6, p. 523; sum of horses, mule[illegible]ses and burros.

Table B-1.- TOTAL CAPITAL INVESTMENT, BY CLASS OF INVESTMENT AND BY FARMING AREA, FOR SPECIFIED YEARS, 1919-3 Continued

[h]Fifteenth Census of the United States 1930, Agriculture, Vol. IV, chap. 8, table 2, p. 551 ff.; value of total li ck minus sum of horses, mules, asses, and burros.

[i]Census of Agriculture 1935, Vol. III, chap. V, table 5, p. 252 ff.; sum of "horses and colts" and "mules and colts

[j]Fourteenth Census of the United States 1920, Agriculture, Vol. V, chap. IX, table 6, p. 523 ff.; sum of cattle, s goats, and swine plus chickens from same source, table 63, p. 601.

[k]Census of Agriculture 1935, Vol. III, chap. V, sum of: All cattle and calves (table 8, p. 258); swine all ages (e 13, p. 268); sheep and lambs (table 16, p. 273); goats and kids (table 20, p. 280); and chickens over 3 months (table 24, p. 28

n.a. Data not available.

Table B-2.- FARM CAPITAL INVESTMENT PER FARM, BY CLASS [illegible]STMENT AND FARMING AREA, FOR SPECIFIED YEARS, 1910-1935[a]

([illegible])

Class of investment	United States	Corn	Eastern Dairy	Western Dairy	Middl[illegible] East[illegible]	[illegible]stern [illegible]tton	Delta Cotton	Western Cotton	Small Grain	Range	North-western	Cali-fornia
Land												
1910	$4,476	$ 8,897	$2,896	$4,715	$1,8[illegible]	[illegible],173	$1,128	$3,753	$10,313	$ 5,732	$ 8,639	$14,966
1920	8,503	17,705	3,766	9,464	3,6[illegible]	[illegible],579	2,552	7,033	20,018	11,021	12,000	23,585
1930	5,554	9,317	3,516	5,743	2,4[illegible]	[illegible],504	1,581	5,857	12,205	8,311	8,637	21,882
1935[b]	4,824	7,685	5,479	5,760	2,3[illegible]	[illegible],570	1,418	4,703	9,121	6,188	6,737	15,500
Total capital goods												
1910	1,441	2,226	2,023	1,952	7[illegible]	445	510	1,110	2,676	2,519	1,894	2,499
1920	2,603	4,168	3,600	3,792	1,2[illegible]	883	896	2,033	4,854	4,573	3,372	4,009
1930	2,420	3,940	4,154	4,176	1,1[illegible]	617	596	1,630	4,490	4,106	3,029	3,832
1935	1,664	n.a.	n.a.	n.a.	n.[illegible]	[illegible].a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Buildings[c]												
1910	450	798	968	791	2[illegible]	104	92	178	632	315	398	636
1920	807	1,522	1,487	1,478	3[illegible]	218	175	371	1,262	607	759	1,034
1930	933	1,773	2,031	1,886	4[illegible]	207	163	385	1,382	728	946	1,368
1935	792	n.a.	n.a.	n.a.	n.[illegible]	[illegible].a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Machinery												
1910	199	273	338	287	[illegible]	70	87	138	372	220	301	409
1920	558	884	796	837	2[illegible]	192	181	374	1,178	669	854	1,153
1930	525	748	937	854	1[illegible]	128	144	393	1,207	722	792	1,000
1935	372	n.a.	n.a.	n.a.	n.[illegible]	[illegible].a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Workstock												
1910	412	593	329	428	2[illegible]	189	215	416	905	551	586	636
1920	399	479	355	369	2[illegible]	272	295	471	760	545	468	364
1930	215	312	229	300	1[illegible]	142	128	200	336	252	196	140
1935	204	287	200	260	1[illegible]	165	125	210	303	233	206	127
Other livestock												
1910	380	562	388	446	1[illegible]	82	116	378	767	1,433	609	818
1920	839	1,283	962	1,108	3[illegible]	[illegible]01	245	817	1,654	2,752	1,291	1,458
1930	747	1,107	957	1,136	3[illegible]	[illegible]40	161	652	1,565	2,404	1,095	1,324
1935	296	450	446	402	1[illegible]	83	84	252	489	812	459	593

[a]Data from table B-1 divided by average number of farms from U.[illegible]us of Agriculture: 1935, Vol. III, chap. I, table 12, p. 34 ff.

[b]Land and buildings; no separate classification available.

[c]Omitting dwellings of operators.

n.a. Data not available.

Table B-3. VALUE OF HARVESTING AND THRESHING EQUIPMENT

Annual Sales by Manufacturers for Use in the United States[a]

(Millions of current dollars)

Year	Total grain harvesting equipment	Binders, headers, and threshing equipment	Combines
1920	41.2	37.6	3.6
1921	16.1	13.7	2.4
1922	15.4	13.6	1.8
1923	14.9	13.0	1.9
1924	13.1	10.6	2.5
1925	23.6	17.7	5.8
1926	27.5	17.8	9.7
1927	38.0	21.7	16.3
1928	44.4	18.2	26.2
1929	45.3	17.4	27.9
1930	33.6	12.1	21.5
1931	15.2	6.1	9.1
1932	n.a.	n.a.	n.a.
1933	n.a.	n.a.	n.a.
1934	n.a.	n.a.	n.a.
1935	16.8	12.3	4.5
1936	21.2	10.7	10.5
1937	34.9	14.1	20.8

a. Data for 1920 from H. R. Tolley and L. M. Church, Manufacture and Sale of Farm Equipment in 1920 (U.S. Dept. Agr. Cir. 212); data from 1921 to 1937, inclusive, from annual report of the Bureau of the Census, Manufacture and Sale of Farm Equipment and Related Products.

n.a. Data not available.

Year				
1980	..	..	..	..
1981	..	..	..	..
1982	..	..	..	..
1983	..	..	..	..
1984	..	..	..	..
1985	..	..	..	..
1986	..	..	..	..
1987	..	..	..	..
1988	..	..	..	..
1989	..	..	..	..
1990	..	..	..	..
1991	..	..	..	..
1992	..	..	..	..
1993	..	..	..	..
1994	..	..	..	..
1995	..	..	..	..
1996	..	..	..	..
1997	..	..	..	..
1998	..	..	..	..
1999	..	..	..	..
2000	..	..	..	..

a. Data for 1980-1990 from ... Data for 1991-2000 from ... Data for 1980-1990 from ... Data for 1991-2000, however, from annual reports of the ... Underlying assumptions are ...

b-f. Data not available.

APPENDIX C

CHANGES IN FARM ORGANIZATION IN A SELECTED GROUP OF FARMS

APPENDIX C

CHANGES IN FARM ORGANIZATION IN A SELECTED GROUP OF FARMS

The discussion in the latter part of Chapter VII rests on information obtained in the N.R.P. Field Study of 1936. Since there was a wide variation in organization from farm to farm, this appendix is presented to provide a basis for statistical appraisal of the relationship discussed. In order that the groups of farms would be as homogeneous as possible, those in each group were restricted to a limited and modal size range. They were further limited by the inclusion only of farmers within limited age groups. Since it was thought that adoption of a tractor was likely to be one of the principal influences on farm organization, the farms were further divided into those which had obtained a tractor by 1936 and those which had not.

There are certain differences between tractor and the non-tractor groups because of the relative advantage of such power on different types and sizes of farms. Tractors tend to be adopted first on the more level farms and also on those of greater acreage where they can be utilized most fully. Consequently, in the groups of farms shown in Tables C-1 to C-4 the tractor farms have from 3 to 10 percent more of their land in crops. Most of this is attributable to differences already existing between farms before tractors were adopted.[1]

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1. As an illustration, in the Corn Area there is a larger percentage of farms with tractors in western sections, adjacent to the Small Grain Area, than in the eastern sections of the same area. Also the western Corn Area farms run larger in average size than the eastern ones and have a higher acreage of small grain per farm. This causes some difference in average total acreage and in small grain acreage per farm between tractor and non-tractor groups for the Corn Area.

Table C-1 CHANGES IN FARM ORGANIZATION IN CORN AREA, SELECTED GROUPS OF TRACTOR AND NONTRACTOR FARMS, 1909-36[a]

	Tractor or nontractor	Older farmers[b] 1929	Older farmers[b] 1919	Older farmers[b] 1909	Middle-aged[c] 1929	Middle-aged[c] 1919	Younger[d] 1929
Number farms	Tractor		76		98		62
	Nontractor		53		40		38
Age farmer, 1936	Tractor		58		46		37
	Nontractor		59		48		40
Total acres	Tractor	192	195	180	184	181	170
	Nontractor	178	178	172	169	167	169
Crop acres	Tractor	146	149	137	141	138	133
	Nontractor	126	127	124	125	125	124
Corn	Tractor	71	74	66	67	66	65
	Nontractor	62	64	63	68	65	67
Small grain	Tractor	55	58	52	55	52	51
	Nontractor	42	43	42	39	42	41
Alfalfa hay	Tractor	6	4	2	5	3	6
	Nontractor	5	4	1	5	4	3
Other hay	Tractor	13	14	17	13	17	11
	Nontractor	16	16	17	13	14	12
Total livestock units	Tractor	22.0	22.1	18.3	22.7	21.0	17.8
	Nontractor	23.1	22.3	18.4	20.5	20.9	17.1
Cattle animal units	Tractor	13.4	13.3	11.0	13.5	12.6	10.2
	Nontractor	13.5	12.7	10.5	11.6	12.4	9.6
Number milk cows	Tractor	7.4	7.3	6.4	7.4	6.8	5.5
	Nontractor	6.8	6.2	5.5	6.4	7.2	5.7
No. litters pigs	Tractor	16.3	17.3	13.6	16.2	15.1	12.6
	Nontractor	17.5	18.6	15.3	15.8	16.3	13.7
No. laying hens	Tractor	135	138	125	147	130	122
	Nontractor	140	134	118	138	115	126
No. work horses	Tractor	6.3	7.6	7.4	6.0	6.4	5.4
	Nontractor	6.6	7.0	6.9	6.5	6.4	5.8
Labor-total months	Tractor	25.3	24.6	20.9	21.1	20.4	17.9
	Nontractor	24.2	22.6	21.3	19.4	19.2	17.6
Operator, family, mos.	Tractor	19.8	17.7	14.6	15.5	14.9	13.8
	Nontractor	19.4	16.5	15.4	15.1	13.2	15.0
Hired labor, mos.	Tractor	5.5	6.9	6.3	5.6	5.5	4.1
	Nontractor	4.8	6.1	5.9	4.3	6.0	2.6
Crop acres per man	Tractor	72.5	75.8	83.0	85.6	85.6	94.0
	Nontractor	70.8	74.3	75.7	81.3	81.8	91.2
Livestock units per man	Tractor	10.9	11.3	11.4	10.2	10.0	12.0
	Nontractor	12.8	13.5	11.4	13.6	13.4	12.1

a. Data from N.R.P. Field Study; "Tractor farms" are those with tractors in 1936.
b. Farmers who were 47 to 76 years old in 1936, and who reported for all four perio
c. Farmers who were 37 to 66 years old in 1936, and who reported for all three peri
d. Farmers who were 27 to 56 years old in 1936, and who reported for two periods.

Table C-2 CHANGES IN FARM ORGANIZATION IN WESTERN DAIRY AREA, SELECTED GROUPS OF TRACTOR AND NONTRACTOR FARMS, 1909-36[a]

	Tractor or nontractor	Older farmers[b] 1929	Older farmers[b] 1919	Older farmers[b] 1909	Middle-aged[c] 1929	Middle-aged[c] 1919	Younger[d] 1929
Number farms	Tractor		22		37		14
	Nontractor		8		18		15
Age farmer, 1936	Tractor		58		49		38
	Nontractor		60		48		40
Total acres	Tractor	155	154	147	138	136	145
	Nontractor	136	133	154	133	129	142
Cultivated crops	Tractor	29	26	24	28	27	32
	Nontractor	24	24	27	24	23	28
Corn	Tractor	28	25	23	27	26	31
	Nontractor	24	24	27	24	23	27
Small grain	Tractor	40	39	37	31	30	31
	Nontractor	31	28	31	28	28	26
Alfalfa hay	Tractor	10	7	4	16	12	12
	Nontractor	12	9	5	14	12	18
Other hay	Tractor	19	21	23	14	16	18
	Nontractor	17	20	25	11	14	15
Total livestock units	Tractor	39.2	36.5	31.1	38.9	36.5	43.2
	Nontractor	35.8	29.6	31.1	36.2	35.4	38.1
Cattle animal units	Tractor	33.3	30.8	26.3	33.0	31.9	35.7
	Nontractor	29.7	23.6	25.6	29.9	29.6	32.0
Number milk cows	Tractor	19.7	18.4	16.0	20.2	19.7	22.4
	Nontractor	18.0	14.9	15.5	18.9	19.2	20.3
No. litters pigs	Tractor	8.0	8.1	6.6	6.1	4.9	5.3
	Nontractor	7.0	7.3	5.9	7.9	7.6	7.7
No. laying hens	Tractor	94	80	76	113	85	96
	Nontractor	125	119	101	110	85	112
No. work horses	Tractor	4.4	4.9	4.8	5.2	5.5	4.0
	Nontractor	5.2	5.1	5.5	4.7	4.5	4.5
Labor-total months	Tractor	31.7	27.2	26.4	27.5	25.5	27.3
	Nontractor	27.6	24.2	25.3	24.8	20.8	22.6
Operator, family months	Tractor	22.7	18.3	17.6	19.5	17.3	15.2
	Nontractor	22.4	16.8	16.8	19.4	15.1	16.2
Hired labor, months	Tractor	9.0	8.9	8.8	8.0	8.2	12.1
	Nontractor	5.2	7.4	8.5	5.4	5.7	6.4
Crop acres per man	Tractor	37.9	42.3	40.3	39.7	38.7	45.7
	Nontractor	36.7	39.8	42.5	39.2	46.1	45.4
Livestock units per man	Tractor	14.9	16.9	14.5	17.7	16.8	19.1
	Nontractor	14.9	14.4	14.4	18.5	21.3	20.2

a. Data from N.R.P. Field Study; "Tractor farms" are those with tractors in 1936.
b. Farmers who were 47 to 76 years old in 1936, and who reported for four periods.
c. Farmers who were 37 to 66 years old in 1936, and who reported for three periods.
d. Farmers who were 27 to 56 years old in 1936, and who reported for two periods.

Table C-3 CHANGES IN FARM ORGANIZATION IN EASTERN DAIRY AREA, SELECTED GROUPS OF TRACTOR AND NONTRACTOR FARMS, 1909-36[a]

	Tractor or nontractor	Older farmers[b] 1929	Older farmers[b] 1919	Older farmers[b] 1909	Middle-aged[c] 1929	Middle-aged[c] 1919	Younger[d] 1929
Number farms	Tractor		22			29	22
	Nontractor		19			23	24
Age farmer, 1936	Tractor		61			49	40
	Nontractor		66			50	43
Total acres	Tractor	143	144	130	134	135	139
	Nontractor	128	125	113	138	134	124
Crop acres	Tractor	72	72	65	69	71	64
	Nontractor	61	59	53	60	56	56
Corn	Tractor	14	17	15	13	13	15
	Nontractor	11	10	9	9	8	6
Small grain	Tractor	20	20	18	19	20	21
	Nontractor	17	17	16	15	14	11
Alfalfa hay	Tractor	5	3	2	1	*	*
	Nontractor	*	-	-	1	*	1
Other hay	Tractor	26	27	29	31	33	24
	Nontractor	31	30	26	33	32	37
Total livestock units	Tractor	30.1	33.5	26.9	31.3	28.2	24.6
	Nontractor	26.1	24.9	22.9	28.4	27.1	23.6
Cattle animal units	Tractor	26.8	28.6	23.2	28.0	24.8	22.1
	Nontractor	23.6	22.5	20.1	25.7	25.2	21.2
Number milk cows	Tractor	16.5	17.4	14.0	16.9	15.1	13.5
	Nontractor	14.2	13.9	12.4	16.2	15.7	13.0
No. litters pigs	Tractor	.9	3.5	2.0	1.5	2.0	.5
	Nontractor	.6	.8	1.1	.5	.5	*
No. laying hens	Tractor	104	85	64	99	66	99
	Nontractor	93	67	61	88	55	72
No. work horses	Tractor	3.9	4.1	4.0	3.3	3.8	3.2
	Nontractor	3.4	3.6	3.2	3.4	3.3	2.5
Labor-total months	Tractor	29.5	30.3	27.1	26.0	23.1	24.2
	Nontractor	23.5	20.4	19.9	20.1	20.0	20.6
Operator, family mos.	Tractor	20.0	16.5	13.6	15.5	13.5	16.8
	Nontractor	18.0	15.1	13.8	16.6	16.5	15.6
Hired labor, mos.	Tractor	9.5	13.8	13.5	10.5	9.6	7.4
	Nontractor	5.5	5.3	6.1	3.5	3.5	5.0
Crop acres per man	Tractor	34.4	30.4	30.5	34.6	40.6	34.3
	Nontractor	31.1	37.4	32.5	37.7	35.8	35.8
Livestock units per man	Tractor	13.1	14.5	12.8	15.6	15.7	12.8
	Nontractor	14.3	16.2	15.1	17.7	17.4	15.0

a. Data from N.R.P. Field Study; "Tractor farms" are those with tractors in 1936.
b. Farmers who were 47 to 76 years old in 1936, and who reported for four periods.
c. Farmers who were 37 to 66 years old in 1936, and who reported for three periods.
d. Farmers who were 27 to 56 years old in 1936, and who reported for two periods.
* Less than .5 of the unit in which item is recorded.

Table C-4 CHANGES IN FARM ORGANIZATION IN THE SMALL GRAIN AREA, SELECTED GROUPS OF TRACTOR AND NONTRACTOR FARMS, 1909-36[a]

	Tractor or nontractor	Older farmers[b] 1929	Older farmers[b] 1919	Older farmers[b] 1909	Middle-aged[c] 1929	Middle-aged[c] 1919	Younger[d] 1929
Number farms	Tractor		47			109	92
	Nontractor		19			25	15
Age farmer, 1936	Tractor		60			48	39
	Nontractor		58			47	41
Total acres	Tractor	495	523	488	488	464	449
	Nontractor	447	411	488	427	448	393
Crop acres	Tractor	358	357	297	362	326	341
	Nontractor	271	272	257	252	261	179
Corn	Tractor	31	31	25	32	27	23
	Nontractor	35	30	24	47	39	32
Small grain	Tractor	279	280	219	259	244	250
	Nontractor	154	158	142	164	181	116
Alfalfa hay	Tractor	7	6	3	7	5	3
	Nontractor	8	8	2	7	4	6
Other hay	Tractor	15	18	24	20	20	15
	Nontractor	47	48	70	18	27	12
Total livestock units	Tractor	18.4	19.9	16.2	18.1	13.2	13.6
	Nontractor	21.5	15.8	13.0	15.9	14.8	13.4
Cattle animal units	Tractor	13.4	15.0	10.9	13.0	9.6	9.9
	Nontractor	16.2	12.4	10.0	10.6	9.9	11.3
Number milk cows	Tractor	8.0	7.7	5.5	7.5	5.9	6.1
	Nontractor	9.4	7.6	5.3	6.8	6.5	8.5
Number litters pigs	Tractor	5.6	6.8	4.9	4.9	3.9	3.7
	Nontractor	3.6	4.4	4.6	6.0	8.0	2.2
Number laying hens	Tractor	103	106	90	101	86	76
	Nontractor	78	72	56	85	74	46
Number work horses	Tractor	7.5	12.0	10.1	7.1	10.2	5.2
	Nontractor	8.6	9.3	8.1	7.9	8.9	6.2
Labor-total months	Tractor	23.4	25.2	21.5	20.5	20.5	16.7
	Nontractor	22.8	19.6	17.7	17.7	18.3	16.6
Operator and family months	Tractor	19.0	20.5	16.4	15.7	15.2	14.1
	Nontractor	20.7	16.7	14.2	14.7	14.9	14.1
Hired labor, months	Tractor	4.4	4.7	5.1	4.8	5.3	2.6
	Nontractor	2.1	2.9	3.5	3.0	3.4	2.5
Crop acres per man	Tractor	202.9	187.5	167.1	225.7	193.3	258.5
	Nontractor	161.6	170.5	162.1	178.5	170.8	142.8
Livestock units per man	Tractor	9.9	10.0	8.2	10.4	7.9	9.1
	Nontractor	13.1	9.6	8.3	11.2	9.9	9.6

a. Data from NRP Field Study; "Tractor farms" are those with tractors in 1936.
b. Farmers who were 47 to 76 years old in 1936, and who reported for four periods.
c. Farmers who were 37 to 66 years old in 1936, and who reported for three periods.
d. Farmers who were 27 to 56 years old in 1936, and who reported for two periods.

Sizes of farms included in these tabulations were limited as follows: Corn Area, 140-259 acres; Dairy Areas, 100-199 acres; Small Grain Areas, 300-699 acres. All sizes refer to 1936. The acreage operated by a given farmer, however, may differ from one period to another. In the Field Study data were obtained for the four years 1936, 1929, 1919, and 1909. In this particular analysis it was desired to make comparisons between groups of farmers who were of comparable ages at the same stage of their farming history. Consequently, of the farmers from whom schedules were obtained for all four periods, only those schedules were used which were obtained from farmers who were 47 to 76 years old in 1936. For the three-period farms only schedules from farmers who were 37-66 years of age in 1936 were used, and for the two-period records only those from farmers who were 27-56 years old in 1936. This means that in these tabulations, schedules were used only from those farmers who were 20 to 49 years of age in the first year for which information was obtained.

TABLE C-5. STANDARD DEVIATION OF CROP ACRES PER MAN AND LIVESTOCK UNITS PER MAN BY AREAS AND AGE OF FARMERS[a]
Farms studied in N.R.P. Survey

	Tractor or nontractor farms	Older farmers[b] 1929	Older farmers[b] 1919	Older farmers[b] 1909	Middle-aged farmers[c] 1929	Middle-aged farmers[c] 1919	Younger farmers[d] 1929
Corn Area							
Crop acres per man	Tractor	27.24	27.47	31.34	28.42	30.00	31.40
	Nontractor	26.95	27.65	30.31	29.50	31.75	33.12
Livestock units per man	Tractor	5.62	6.39	5.92	11.97	10.88	6.13
	Nontractor	5.95	6.20	5.55	6.70	8.17	5.33
Eastern Dairy Area							
Crop acres per man	Tractor	17.98	10.26	10.07	12.73	17.20	17.30
	Nontractor	11.73	13.15	12.84	14.96	12.85	15.11
Livestock units per man	Tractor	3.99	7.09	6.35	6.27	7.08	7.93
	Nontractor	4.91	9.34	6.32	7.50	8.98	6.42
Western Dairy Area							
Crop acres per man	Tractor	9.74	7.53	9.23	14.25	11.09	17.78
	Nontractor	7.82	7.64	10.53	12.23	12.44	12.38
Livestock units per man	Tractor	4.18	6.91	6.44	6.21	6.24	7.12
	Nontractor	5.47	5.77	6.69	6.04	7.26	5.56
Small Grain Area							
Crop acres per man	Tractor	121.03	105.38	93.82	100.81	92.37	140.99
	Nontractor	98.84	85.40	102.18	67.71	84.49	59.45
Livestock units per man	Tractor	5.59	5.94	4.87	5.60	4.92	6.22
	Nontractor	12.54	5.10	5.58	6.17	7.31	5.70

a) Data derived from NRP Field Study; "Tractor farms" are those with tractors in 1936, see Tables C-1 to C-4 for average crop acres and average livestock units per man for these farms.
b) Farmers who were 47 to 76 years old in 1936, and who reported for four periods.
c) Farmers who were 37 to 66 years old in 1936, and who reported for three periods.
d) Farmers who were 27 to 56 years old in 1936, and who reported for two periods.

TABLE C-6. TESTS OF SIGNIFICANCE OF VARIATION IN CROP ACRES AND IN LIVESTOCK UNITS PER MAN; WITH REGARD TO AGE OF OPERATOR AND TYPE OF POWER USED[a]

	:Degrees of :freedom between sub-classes	:Degrees of :freedom within sub-classes	: Value of F
Tests of Variation between groups of farms in 1929, in crop acres per man			
Corn Area			
Age	2	361	14.23**
Power	1	361	0.83°
Age power interaction	2	361	0.06°
Western Dairy Area			
Age	2	108	3.30*
Power	1	108	0.06°
Age power interaction	2	108	0.01°
Eastern Dairy Area			
Age	2	133	0.60°
Power	1	133	0.03°
Age power interaction	2	133	0.55°
Small Grain Area			
Age	2	301	0.63°
Power	1	301	19.48**
Age power interaction	2	301	2.40*
Tests of variation between age groups in 1929, livestock units per man			
Western Dairy Area	2	111	5.25**
Eastern Dairy Area	2	136	2.93x

a) For method of analysis see George W. Snedecor, Statistical Methods, Publ. Collegiate Press, Ames, Iowa, 1938, especially chapters 10 and 11.

o) Non-significant.

x) In successive groups of random samples drawn from a homogeneous population, not more than 20 percent (of such samples) would be expected to exceed this value of F.

*) Significant, as above, within the 5 percent point.

**) " " " 1 " .

Table C-7. TESTS OF SIGNIFICANCE OF VARIATION IN CROP ACRES PER MAN; TRACTOR AND NON-TRACTOR FARMS, BETWEEN GROUPS OF FARMERS OF CORRESPONDING AGES IN 1909, 1919 and 1929[a]

Area and type of power	Degrees of freedom between years	Degrees of freedom within years	Value of F
Corn Area			
Tractor farms	2	233	2.37[x]
Non-tractor farms	2	128	2.65[x]
Western Dairy Area			
Tractor farms	2	70	1.69[x]
Non-tractor farms	2	38	0.25[o]
Eastern Dairy Area			
Tractor farms	2	70	2.77[x]
Non-tractor farms	2	63	0.39[o]
Small Grain Area			
Tractor farms	2	245	12.97**
Non-tractor farms	2	56	0.51[o]

a) For method of analysis see George W. Snedecor, Statistical Methods, Pub. Collegiate Press, Ames, Iowa, 1938, especially chapters 10 and 11.

o) Non-significant.

x) In successive groups of random samples drawn from a homogeneous population. Not more than 20 percent (of such samples) would be expected to exceed this value of F.

* Significant, as above, within the 5 percent point.

**) Significance, as above, within the 1 percent point.

The data from the Survey happened to be rather easily available in the age groups and the power groups just mentioned. The age limits of farm operators, however, overlapped and it was thought that this might obscure the true relationships of age of operator to crop acres per man or to other data. Consequently the data from the Corn Area were also classified into smaller, but more homogeneous groups which did not overlap. The relationships of age of operator, type of power, and so on, to crop acres per man, were practically the same as those shown in tables C-1, C-6, and C-7, strengthening the presumption in favor of the data presented here.

It has been indicated that there is a tendency for older farmers to operate fewer acres of crops per 12 months of labor employed on their farms. In table C-6 it is shown that the relationship of age to crop acres per man was highly significant in the Corn Area data and was significant on the Western Dairy Area farms. In the Eastern Dairy, and the Small Grain areas, however, the relationship was not strong enough or regular enough to be statistically significant.

In the Small Grain Area, however, there was a strongly significant relationship between type of power used and crop acres per man, which did not appear elsewhere according to these data. Also, in this area an interesting relationship was found to exist between age of operator and the effect of type of power on crop acres per man. The difference between crop acres per man on tractor and non-tractor farms was greater among the younger operators than it was among the older men. This

variation was significant within the 20 percent point. Table C-4 shows that there was a pronounced and rather regular decline in crop acres per man from the youngest to the oldest group of tractor farmers in 1929. In the group of non-tractor farmers, however, there was no regular variation from one age group to the next. In short, this is consistent with the tendency mentioned in Chapter VII for the younger farmers to make fuller utilization of their tractors than do the older farmers. But it would seem from this that the older men can handle about as many acres of crops with horses as can the younger ones who are using the same type of power.

It was just said that there was no significant relationship between age of operator or type of power and crop acres per man in the two dairy areas. There was, however, a highly significant relationship between age of operator and number of livestock units handled per man in the Western Dairy Area, and a relationship that was significant within the 20 percent point in the Eastern Dairy Area. The difference between groups is found largely in numbers of milk cows and in laying hens.

In table C-7 is shown the tests of significance of the differences in numbers of crop acres per man between groups of operators of corresponding ages, but in different years. That is, the comparisons were made between the numbers of acres handled per man by the older farmers in 1909, when they were approximately 30 years old, the number of acres per man handled in 1919 by men who were then 30 years old, and the acres handled by men of about the same age in 1929. The differences were found to be significant within the 20 percent point in all four areas for the present tractor farmers. Most of the difference is probably attributable to the shift in type of power, since none of the older men had tractors in 1909, a few of the middle aged ones had them in 1919, and the great

majority of the younger ones had them in 1929. For the Small Grain Area the differences were highly significant.

In contrast, the differences were non-significant in all areas but the Corn Area between corresponding age groups of non-tractor farmers. That is to say, the young man in any one of the three other areas who is farming without a tractor, is not able to handle a crop acreage any greater per 12 months of labor, than did a man of equal age in 1909. In the Corn Area, to the contrary, a young man, in 1929, could take care of more acres than a man of similar age in 1909, whether he was using horses or a tractor.

There appear to be two reasons for the similar increase in performance since 1909 in the Corn Area. First, larger sized machinery for the critical operations in this area had been developed for use with horses as well as with tractors. Examples of this are the two-row cultivator and the two-bottom plow, both of which were common in 1927. Second, a majority of the tractors reported for 1929 were still of the standard or four-wheel type. Of those who had the row-crop tractors probably few were getting maximum benefits from them by this year. In other areas, particularly the Small Grain Area, the type of tractor did not matter so much. It seems likely that a similar comparison carried forward to the present time, and between farmers using horses, those using standard type tractors, and those using row-crop tractors, might show a much greater relative improvement for the farmers who now have the row-crop tractors.

APPENDIX E

ELASTICITY OF DEMAND FOR FARM PRODUCTS

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A recent comprehensive study of elasticity of demand for 10 farm products found degrees of elasticity in years since the World War to vary from -2.44 for rye and -0.99 for buckwheat down to -0.12 for cotton and -0.21 for wheat.[1] Another study of the demand

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[1] Schultz, Henry, "The Theory and Measurement of Demand" (Chicago, 1938). The elasticities quoted from Schultz study are in logaritmic terms and represent the average rate of change in amount of the commodities purchased or consumed per percent of change in price. The price data were "deflated" by dividing them through by indexes of the general price level, a procedure which may, to some extent, have affected the results.

The definition and formula for elasticity of demand is stated by Schultz as follows: "When the quantity demanded is a function of the single variable, price, the elasticity of demand may be defined as the ratio of the relative change in quantity demanded to the relative change in price, when the relative changes are infinitesimal." In mathematical symbols

$$\epsilon E = \frac{\frac{dx}{x}}{\frac{dy}{y}} = \frac{d \log x}{d \log y} = \frac{dx}{dy} \cdot \frac{y}{x} \qquad \text{(p. 190)}$$

Schultz attempted to determine elasticity of demand for the commodities given below for each of three periods. Although there were some variations in the exact years in some cases, there were generally: period I- 1879-95, period II- 1896-1914, period III - 1915-29. Elasticities found were:

	Period I	Period II	Period III
Sugar	-0.40	-0.35	-0.29
Corn	-0.74	-0.66	-0.52
Cotton	-0.44	-0.24	-0.12
Hay	-0.79	-0.70	-0.52
Wheat	*	*	-0.21
Potatoes	-0.68	-0.61	-0.31
Oats	-0.57	-0.80	-0.56
Barley	-0.16	-0.22	-0.29
Rye	-0.36	-0.44	-2.44
Buckwheat	-1.28	-0.59	-0.99

*Elasticity found by Schultz for these period was too small to be significant.

for wheat found an elasticity of -0.24[2].

[2]Working, Holbrook, in Econometrica, V. No. 2 (1937), pp. 185-6. An earlier study, however, found an elasticity of -0.6 for wheat during the years 1888-1911; B.A. Lehfeldt, The Economic Journal (London: 1914), Vol. 24, pp. 212-217.

These elasticities mean that, for example, a decline of one percent in the price of wheat would be necessary in order to move an additional .24 of one percent of wheat into consumption, a decline of one percent in the price of hogs would increase the purchases of hogs by only .6 percent, or a decline of 1 percent in the price of cotton would increase the consumption in the United States by only .12 percent.

Relatively fewer industrial than agricultural commodities have been studied in regard to their elasticity of demand, but the common opinion is that nonagricultural products usually have more elastic demands than agricultural ones. This is borne out by the success of manufactures and retailers in stimulating sales of their products by price concessions. Of course, not all agricultural products meet inelastic demands, nor do all nonfarm products meet elastic demands. It is obvious that there is a wide variation in each group.

When drawn on an arithmetic scale, as in figure E-1(B) the lines shown in figure E-1(A) become curves which are convex to the point of origin. That is, values which decline by equal percentages for each percentage of change along the horizontal axis form a

straight line on a double logarithmic scale, but form a curve on an arithmetic scale.

Insert figure E-1 demand schedules with elasticities of 2, 5, 1.0 and 0.4 on arithmetic and logarithmic scales.

Elasticity Differs at Various Stages of Production

It was said that, elasticity of demand differs as between various products. It should also be borne in mind that elasticity in the amounts that will be purchased, differs also for the same product at the various stages of its production, and between producing and consuming areas.[3] It has been mentioned many times that handling

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[3] Working, Holbrook, "The Statistical Determination of Demand Curves," Quarterly Journal of Economics, Vol. XXIX (Aug. 1925), pp. 503-543.

Working points out that the elasticity of demand for potatoes varied at St. Paul from .36 with 80 percent of normal consumption, to .57 at 120 percent of normal, while at Cincinnati it was .41 at 80 percent of normal consumption and .78 at 120 percent of normal.

Such differences in elasticity between different points in a market may be caused, he states, by constant differences in price on account of delivery or handling costs.

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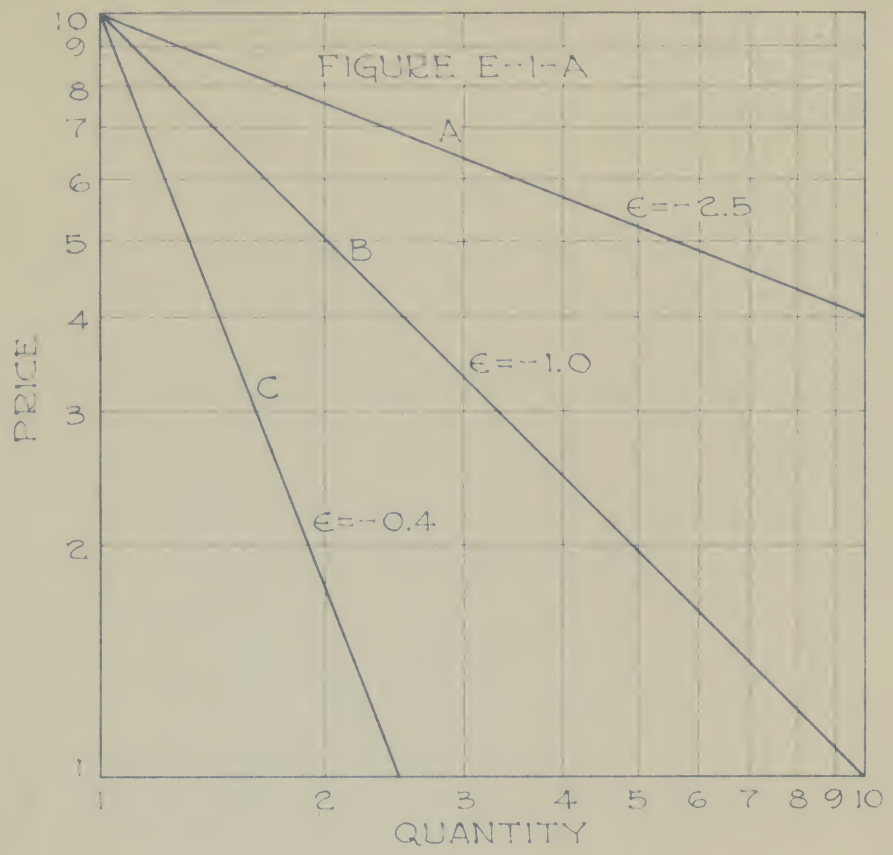
charges per unit tend to change less than prices at the farm, with different sized crops, and the same is true of processing costs. Thus, the demand for labor or for transportation facilities is affected but little by any ordinary variation in the size of any

individual farm crop and the greater part of the change in price to consumers must be borne by the producers.[4]

4. See Richard Been, Jr. and Frederick V. Waugh, Price Spreads Between the Farmer and the Consumer (U.S.D.A. Bureau of Agricultural Economics, Mimeo., July 1936).

The demand price at the farm for potatoes, or wheat, or cotton differs greatly from the demand price at retail for the products which are made from these crops. Thus a bushel of wheat may be expected to make approximately 65 loaves of bread which at 8 cents per pound would retail for about $5.20, while the transportation, milling, baking, and retailing expenses explain, very largely, the difference between the farm price of $.60 or .70 for the bushel of wheat and $5.20 for the bread. Even potatoes commonly retail for twice the price received per bushel by the farmer, while the difference between the farm price of a pound of cotton and the retail price of a shirt is more nearly of the relative magnitude of the difference between wheat and bread.

Now, if a constant difference is deducted from a line or curve drawn on an arithmetic scale, as in figure E-2 (B), the remainders which result form a parallel curve at a lower level. This is represented by curve D in figure E-2 (B). If curves A and D from this figure be drawn on a logarithmic scale like that used in figure E-2 (A), however, it will be seen that the curve D is steeper at each corresponding point above the horizontal scale. Furthermore, curve D becomes increasingly steep as it moves to the right, indicating a smaller and smaller degree of elasticity at lower price ranges. Thus, with relatively constant transportation and processing margins per unit, the price of farm



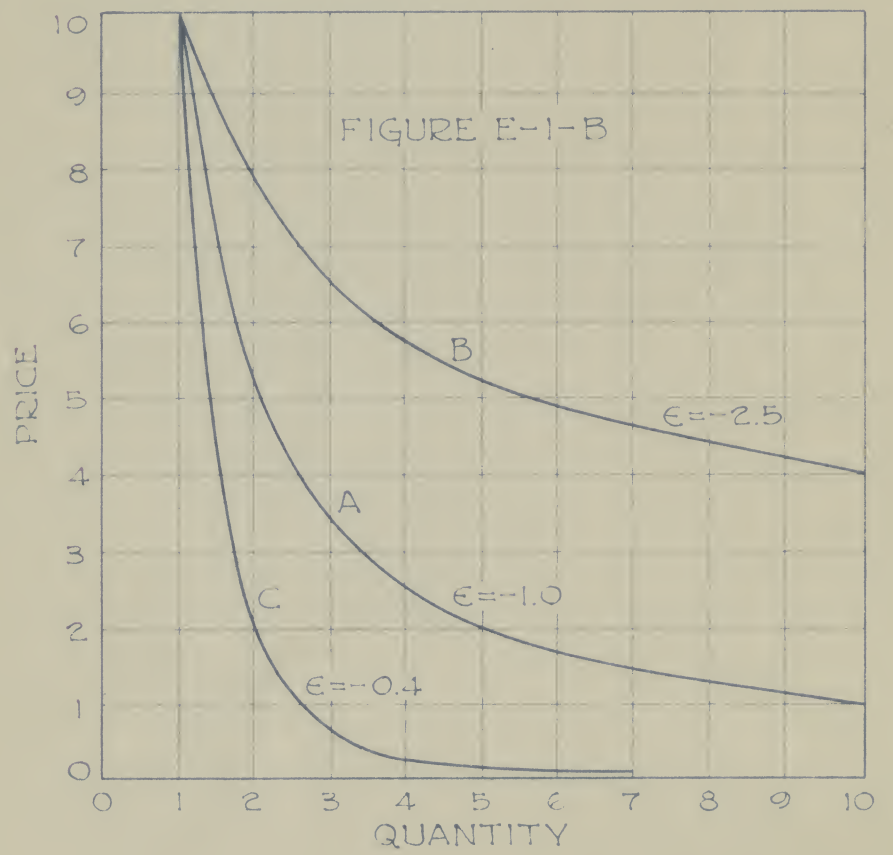
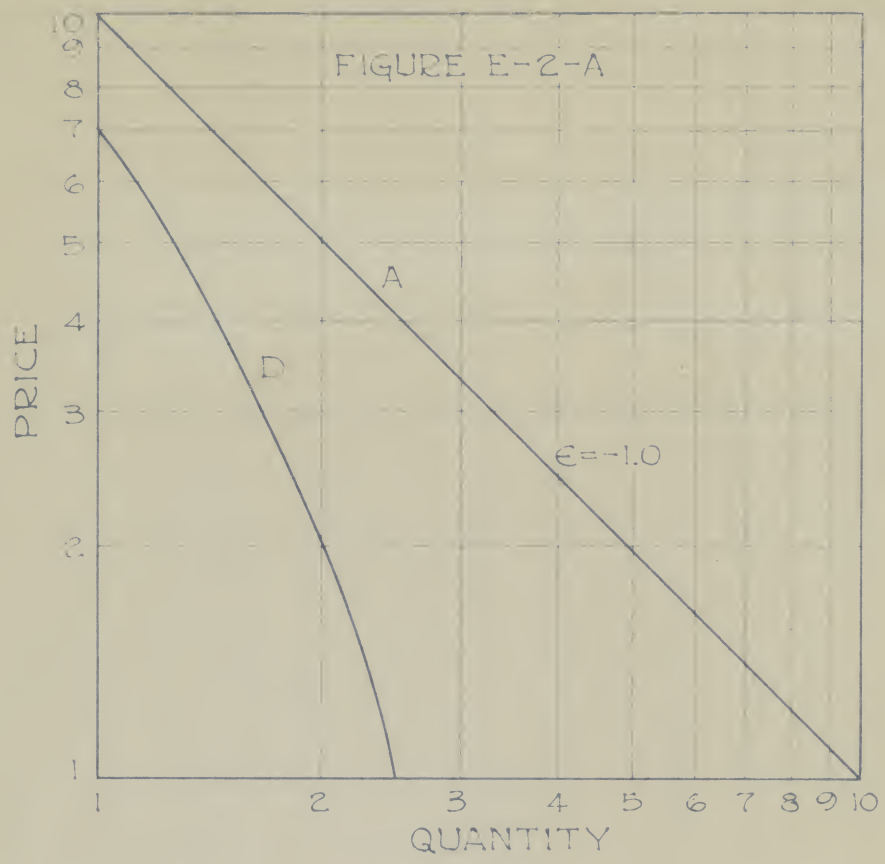


Fig. E-1, DEMAND SCHEDULES WITH ELASTICITIES OF -2.5, -1.0, AND -0.4 ON LOGARITHMIC AND ARITHMETIC SCALES.



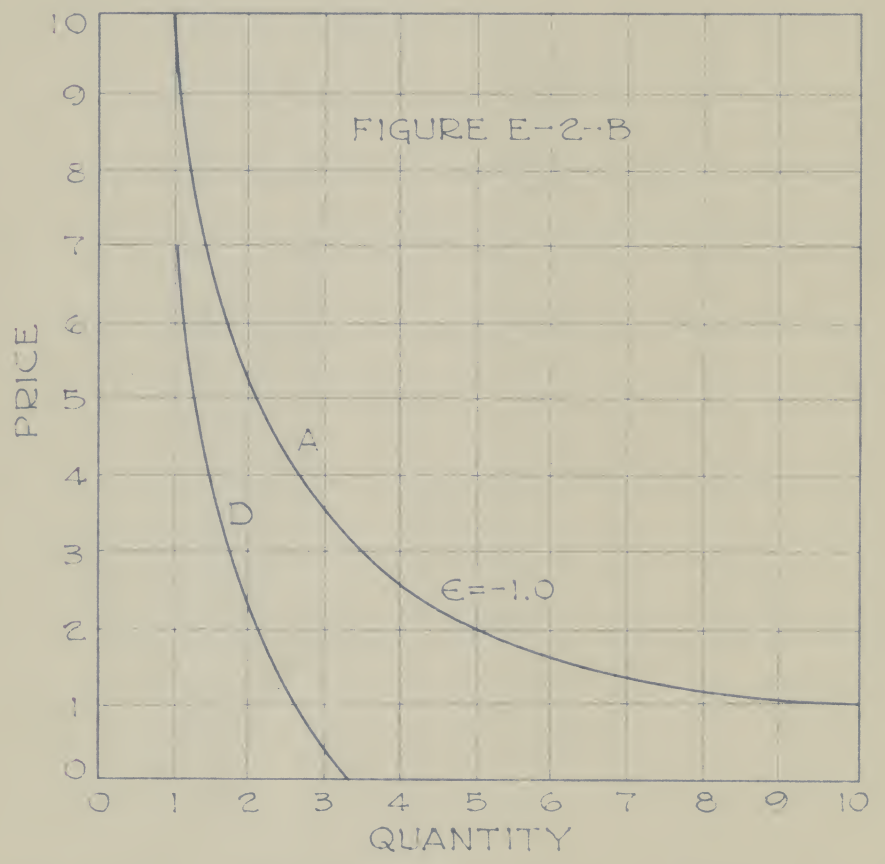


Fig. E-2, DEMAND SCHEDULES BEFORE AND AFTER DEDUCTION OF A CONSTANT DIFFERENCE AT DIFFERENT PRICE LEVELS.

products tends to fall more nearly by a constant amount rather than by a constant percentage per unit of increase in size of crop.

From these relationships it follows that, a product which has a constant degree of elasticity in a retail market will have a different degree of elasticity in the wholesale market. Further, the degree of elasticity will decline with successive increases in the amount of output and consequently a lower price.

This principle, which is at bottom a simple mechanical one, goes far to explain first, why the prices of farm produce fluctuate by greater proportions between years of large or small crops than do the prices of the corresponding commodities at retail.

~~Insert~~ See figure E-2. Demand schedules before and after deduction of a constant difference at various levels of price.

The reader will no doubt have observed by this time that the so-called elasticity of demand for a raw material is a very different thing from the elasticity of demand for the finished and consumable commodity. For the latter, the degree of elasticity is determined by the satiability of the want for which the article is used and by the facility with which other commodities can be substituted for it.

For a raw material the relationship to ultimate utility is or may be very remote. Not only is the degree of elasticity and the form of the curve of demand different for the reasons already given, but there may be a complex maze of interrelationships between the raw commodity in question and other raw materials, as well as opportunities for substitution with regard to the finished or consumable goods. Thus, corn

is a raw material in the manufacture of breakfast foods, which may be substituted for wheat bread. The elasticity of manufacturers' demands for corn for breakfast food is derived from consumers' demands, but for reasons given above is very different in degree. The same is true of the millers' demand for wheat that is to be made into flour for bread. But the elasticity of demand for corn and for wheat for these two competing uses may be quite different, not only because of variations in the consumers' demand curves but also because of differences in the manufacturing and distributing margins.

Further, the demand curve for wheat is very largely derived from the consumers' demand for bread. But only a small fraction of a percent of the corn crop is needed for breakfast foods, and the effect of this use is probably not even observable in the aggregate demand curve for corn. It is chiefly a raw material in the production of pork, beef, milk, etc. The rate of substitution of breakfast food for bread is on an altogether different plane from the substitution of corn for oats or barley or hay in animal production. The former depends on the tastes and habits of human consumers; the latter largely on the varying technical advantages of animal rations composed of different proportions of various feeding stuffs.

There is also another or historical sense in which the demand schedules for farm products have shown a diminishing elasticity. It has been pointed out by Schultz[5] that for a majority of the products

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5. See footnote 1 on page 415.

he studied the degree of elasticity of wholesale demands relative to prices at the farm, was less in recent years than at earlier periods. The explanation for this is probably found in two tendencies. The first of these was that wages of labor in urban places have tended to rise relative to returns to the farmer for the use of his other factors of production. This has increased the spread between prices at the farm and retail prices.

In 1913-16 farmers received, on an average, 53 percent of the dollar paid for 58 food products at retail. During the war period, with higher price levels this increased to 54 percent as is shown in table E-1. Lower price levels and a further rise in the level of urban wages, however, resulted in the farmer's share declining to 46 cents out of the retail dollar by 1922-26 and to 40 cents in 1932-37.

Table E-1. FARM-TO-RETAIL PRICE SPREADS FOR 58 FOODS COMBINED; ESTIMATED RETAIL VALUE AND EQUIVALENT FARM VALUE OF QUANTITIES OF FOOD PURCHASED ANNUALLY BY A TYPICAL AMERICAN WORKINGMAN'S FAMILY, 1913-37[a]

Year	Farm value (dollars)	Retail value (dollars)	Margin (dollars)	Farm value as percent of retail value (percent)	Index of hourly earnings of wage earners (1926=100) (percent)
1913-16	140	263	123	53	46
1917-21	237	436	199	54	81
1922-26	182	393	211	46	96
1927-31	174	388	214	45	100
1932-37	123	309	186	40	88

a) Source: Agricultural Statistics, 1938, table 570, p. 447.

A second cause for an historical reduction in elasticity of wholesale demand for farm products is found in the tendency for goods to be more highly processed before they are delivered to the ultimate consumer. Thus, instead of the housewife buying flour and baking bread herself, there was first a general shift to bakery bread; next there was an increase in the practice of delivering bread and other groceries to the house of the consumer; the individual loaves have been wrapped and the bread has been sliced at the bakery. Such changes widen the margin and decrease the degree of elasticity of wholesalers demand for such products as wheat at the farm.[6] On the other hand, some part

6. Ezekiel, Mordecai, and Louis H. Bean, Economic Bases for the Agricultural Adjustment Act (U. S. Dept. Agr., 1933), pp. 23-6, 40-8.

of the increased degree of processing has undoubtedly been offset by increasing efficiency in the processing industries.

The examples we have discussed have referred to elasticity of demand for farm products at wholesale. Because of lack of comprehensive data on the reaction of consumption to retail price, much less is known about the genuine elasticity of demand by ultimate consumers. Also, but little is known about demand schedules for the great majority of manufactured goods, although manufacturers and dealers have a great stock of practical knowledge regarding the responses of consumers to various levels of prices.